

# MI8 line lattice study

## ❖ Optics

- ▶ Horizontal 1-bump orbits
  - ht800, ht802, ht804 & ht806.
- ▶ Vertical plane 1-bump orbits
  - Closed MP02/vt803/vt805 bump.
    - Adjust Q801 and Q803 current to get bump closure in the calculation.
    - Vertical plane: vt805 & vt807.

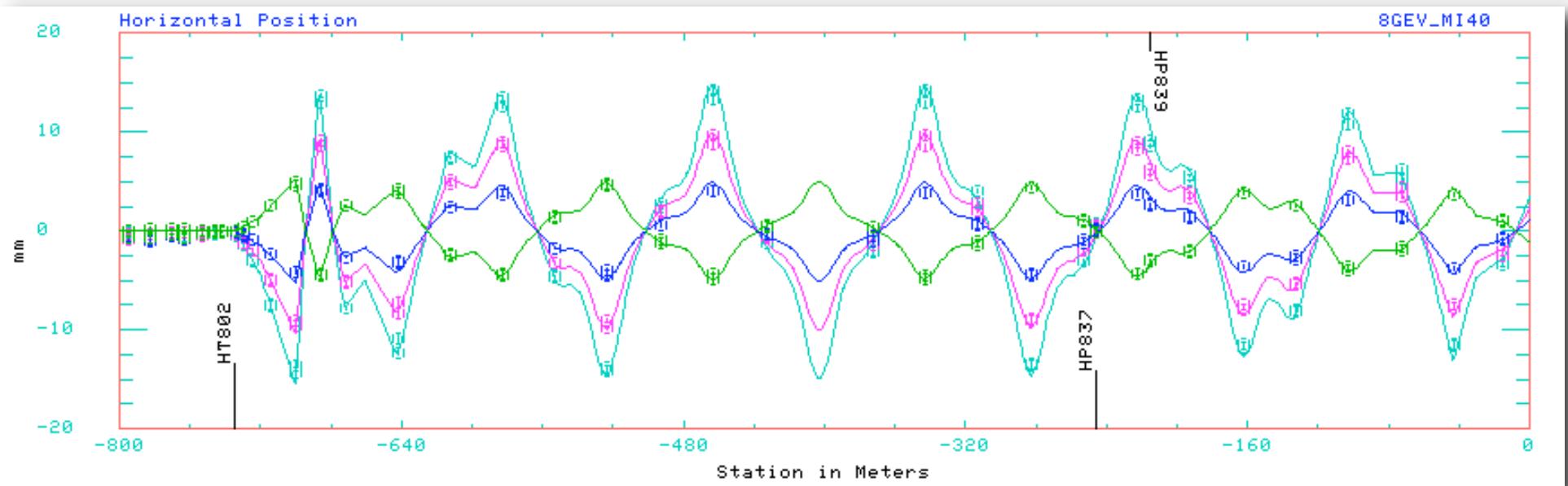
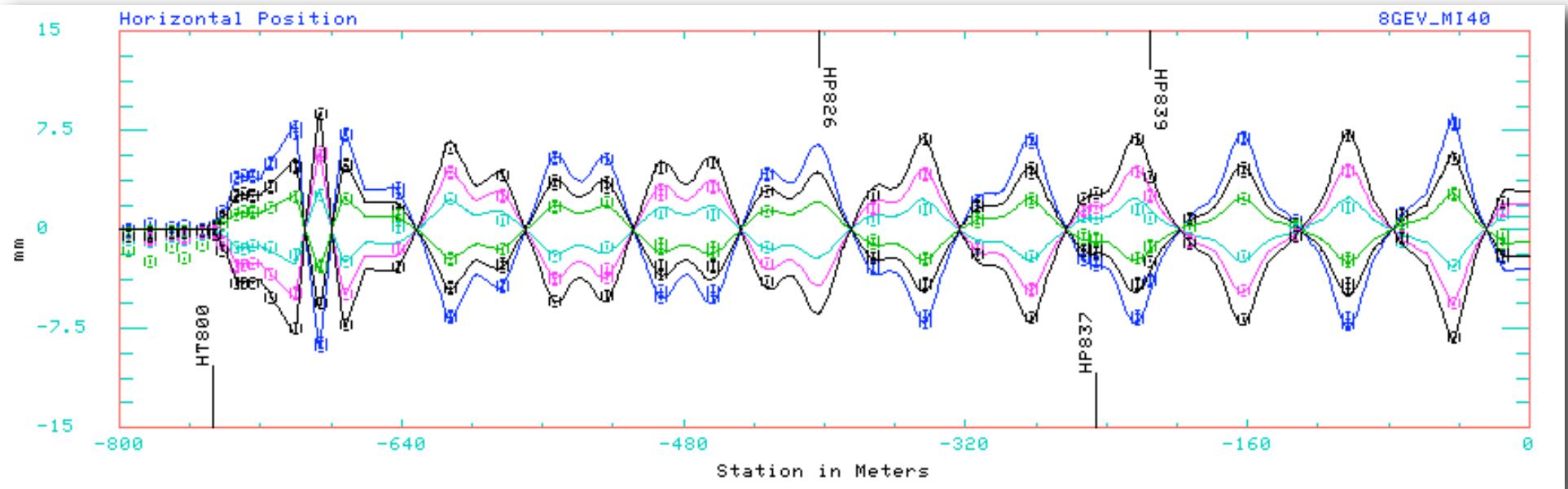
## ❖ Dispersion function

- ▶ Change MI injection frequency.

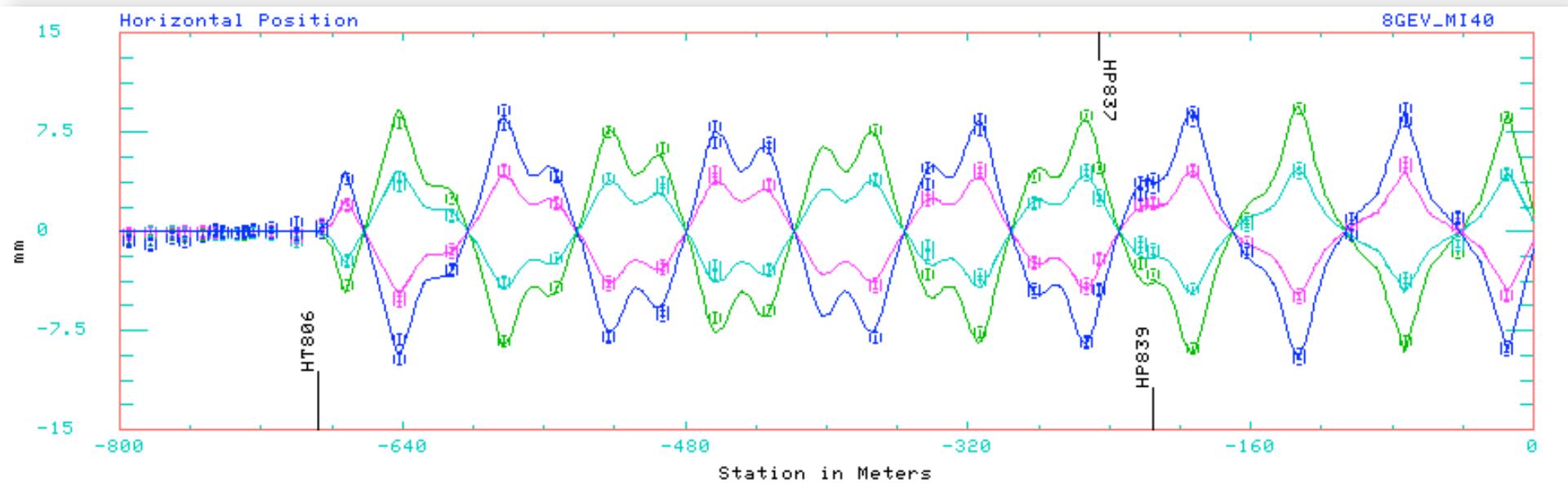
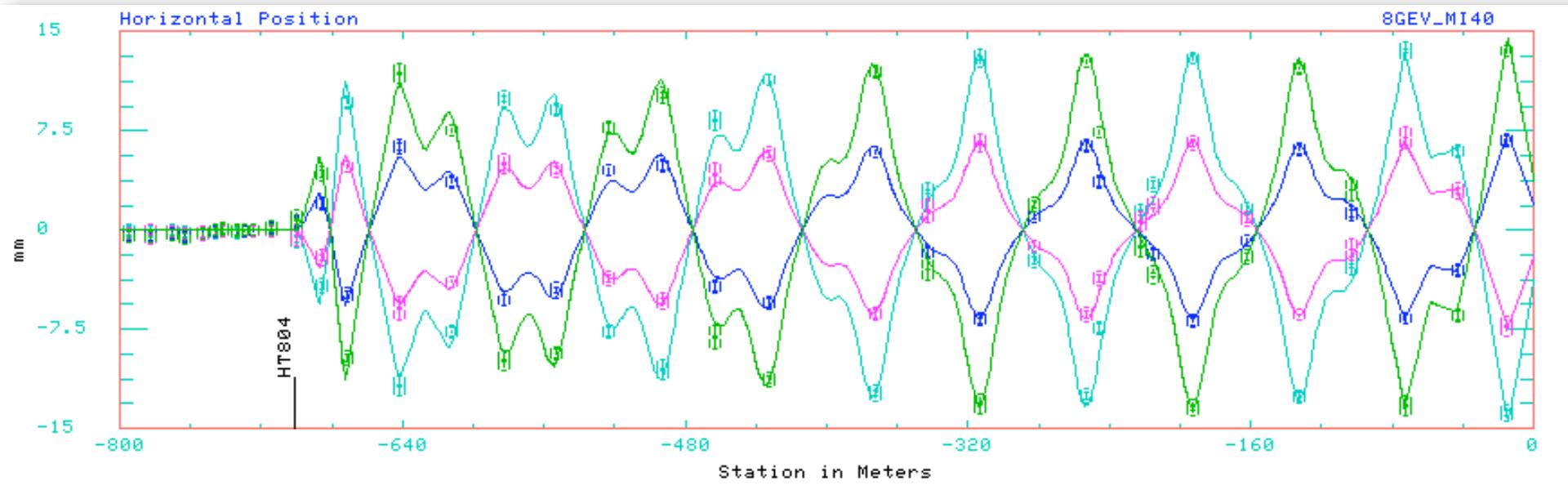
## ❖ Profile sigma data

- ▶ From Booster cycle \$14, \$19 and \$1D.

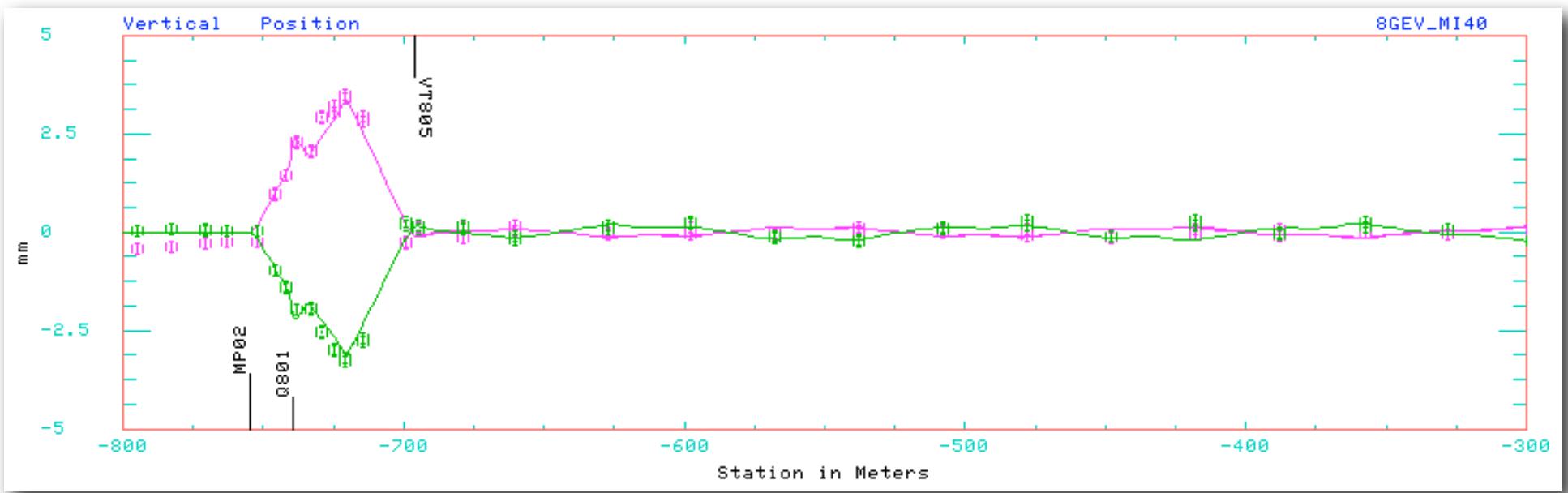
# Horizontal 1-bump orbit, ht800 & ht802



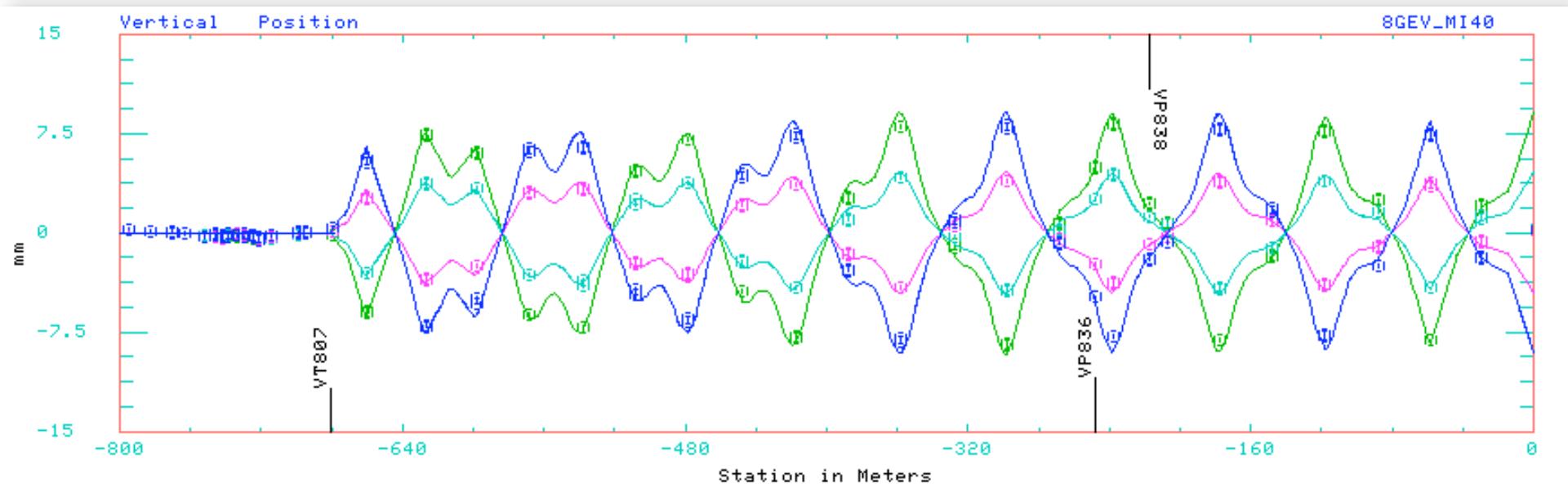
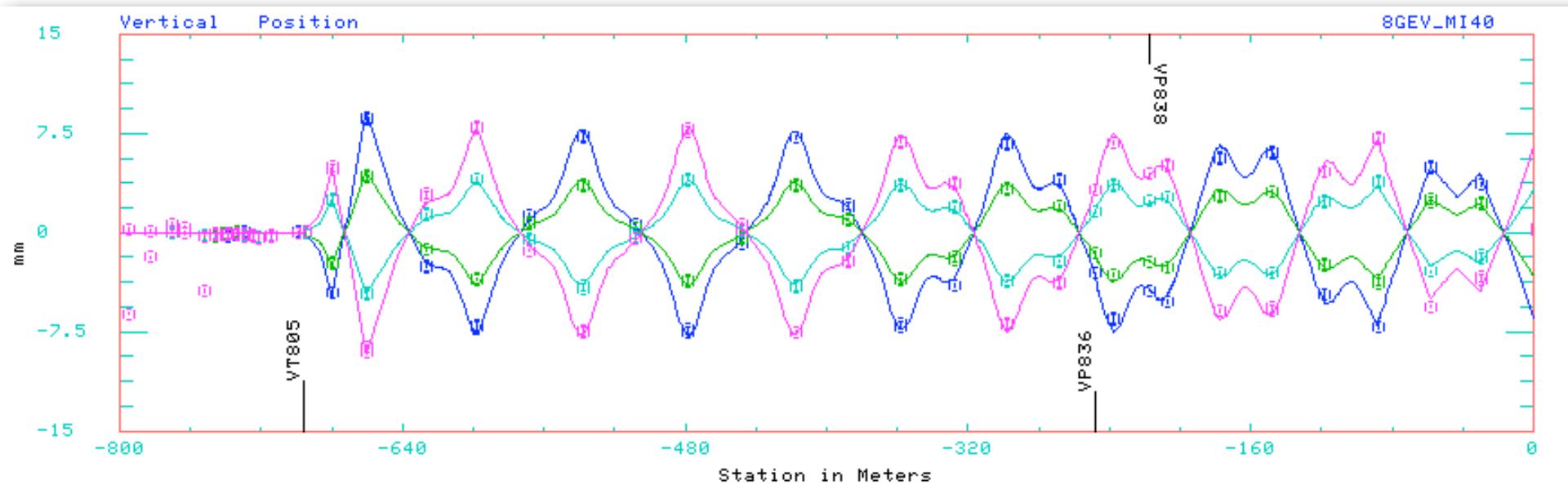
# First order orbit, horizontal



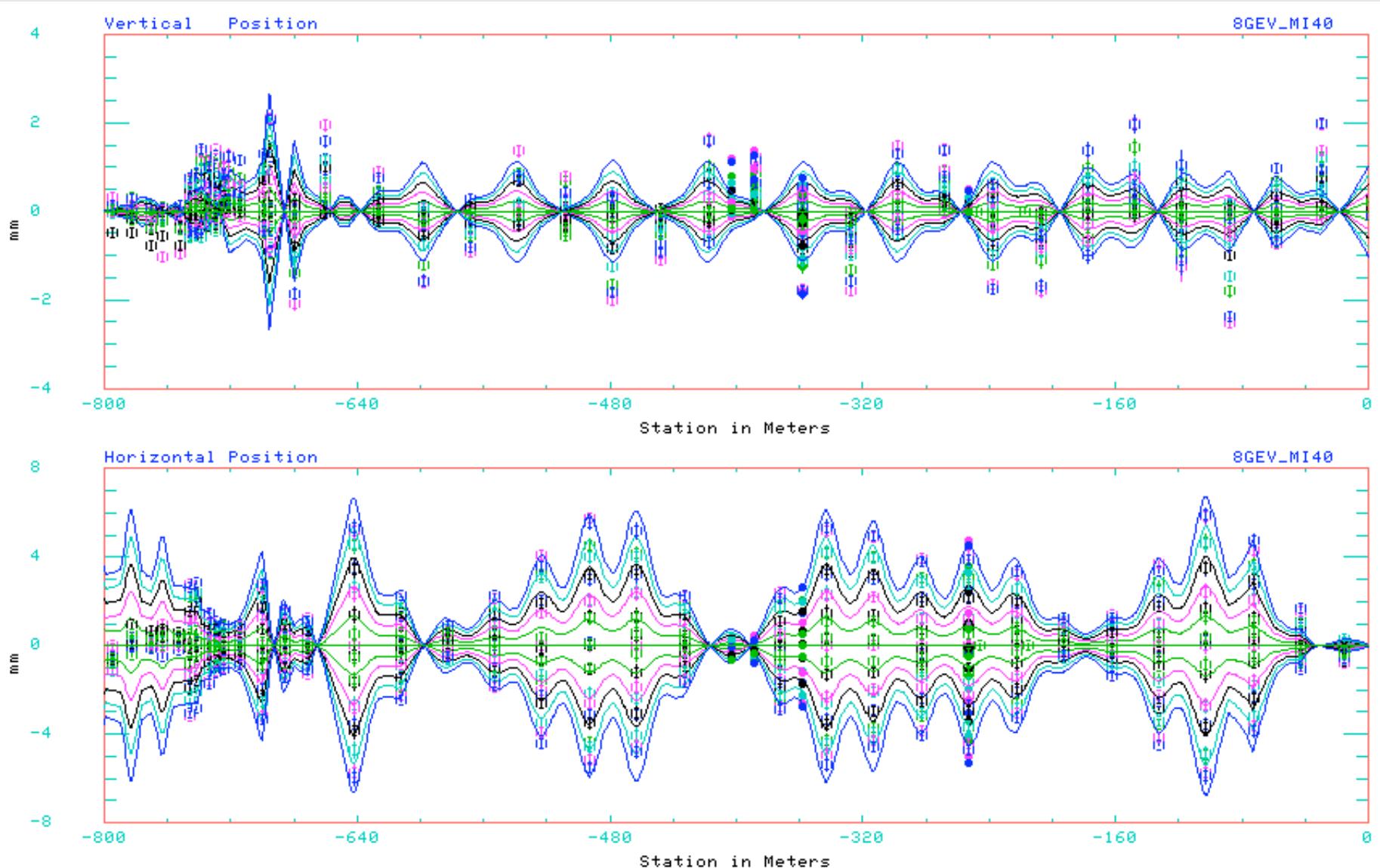
# Closed MP $\emptyset$ 2 bump



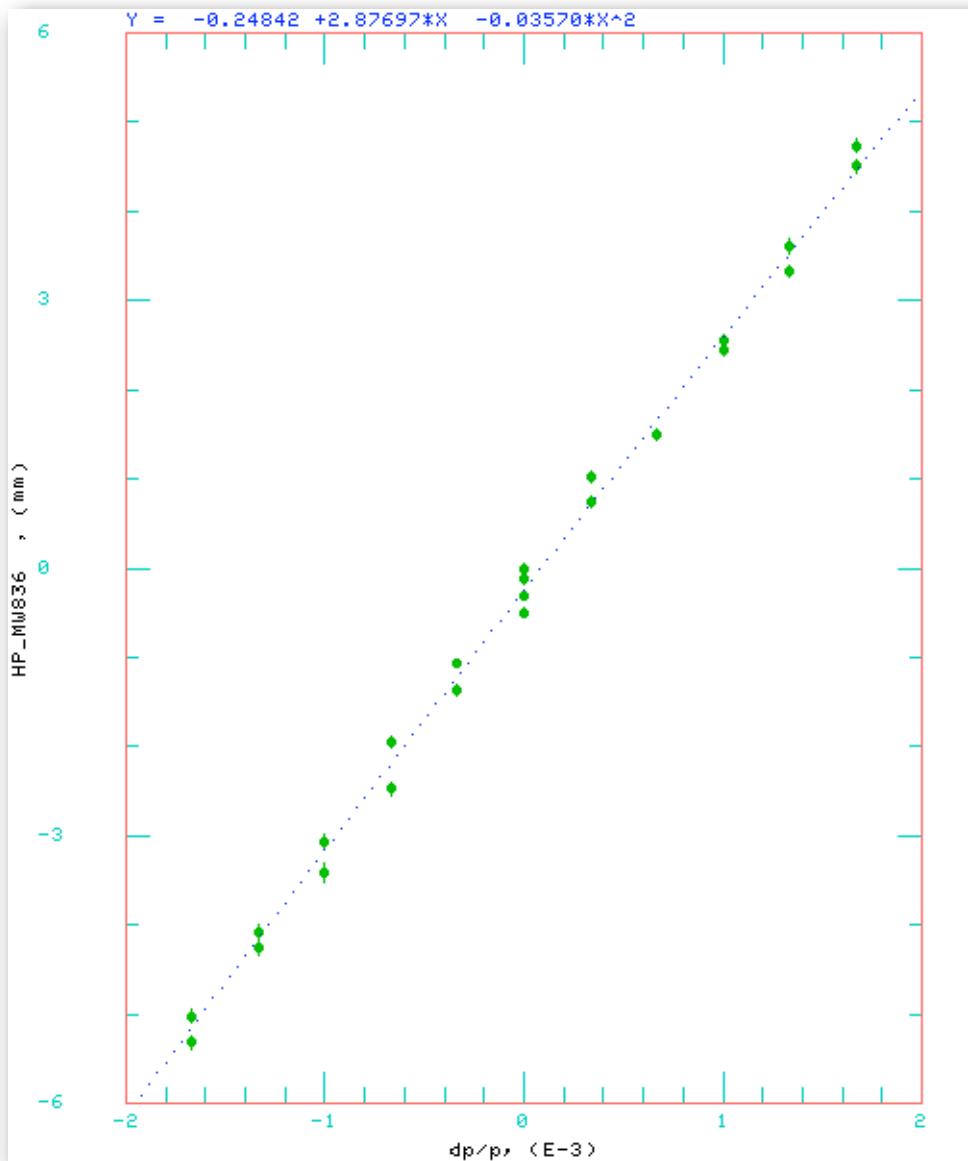
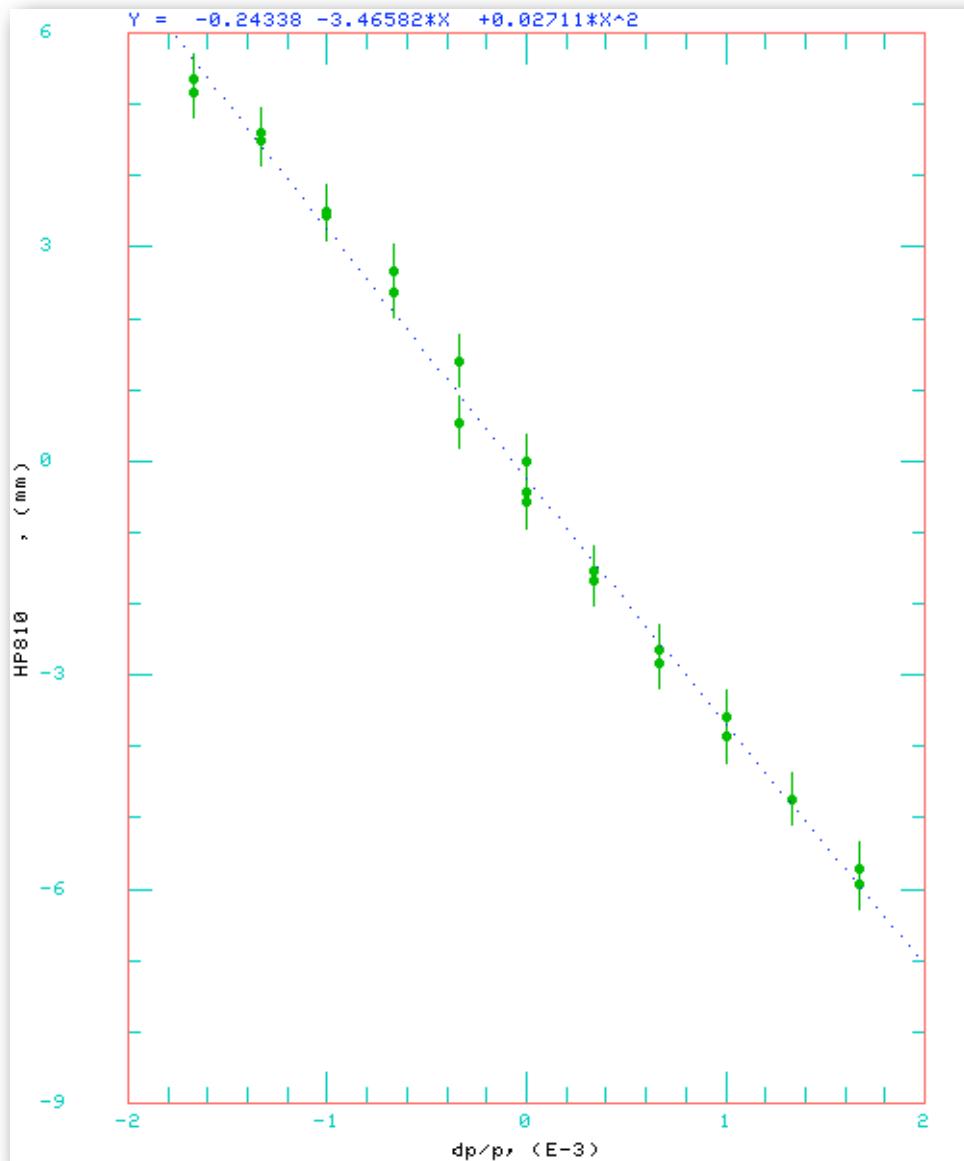
# Vertical 1-bump orbit, vt805 & vt807



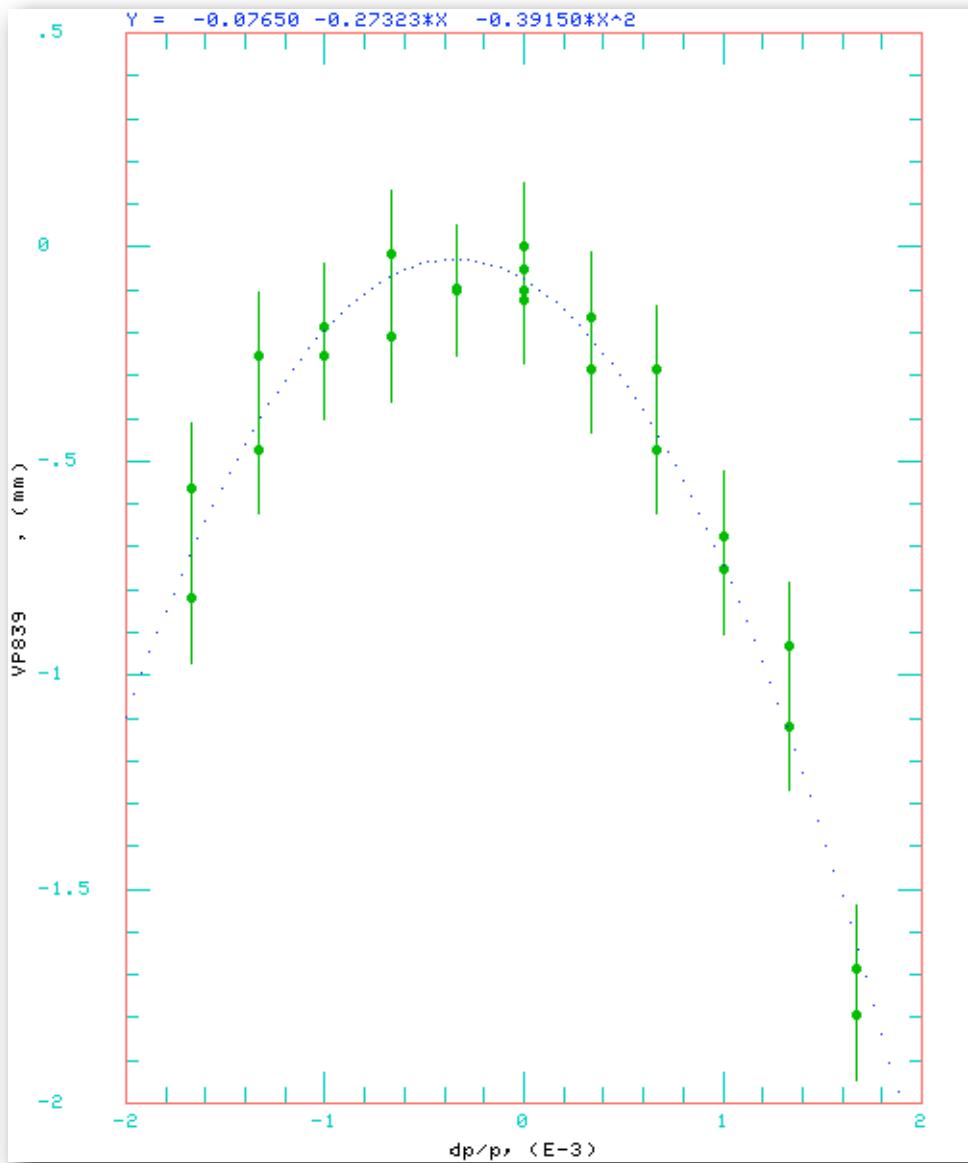
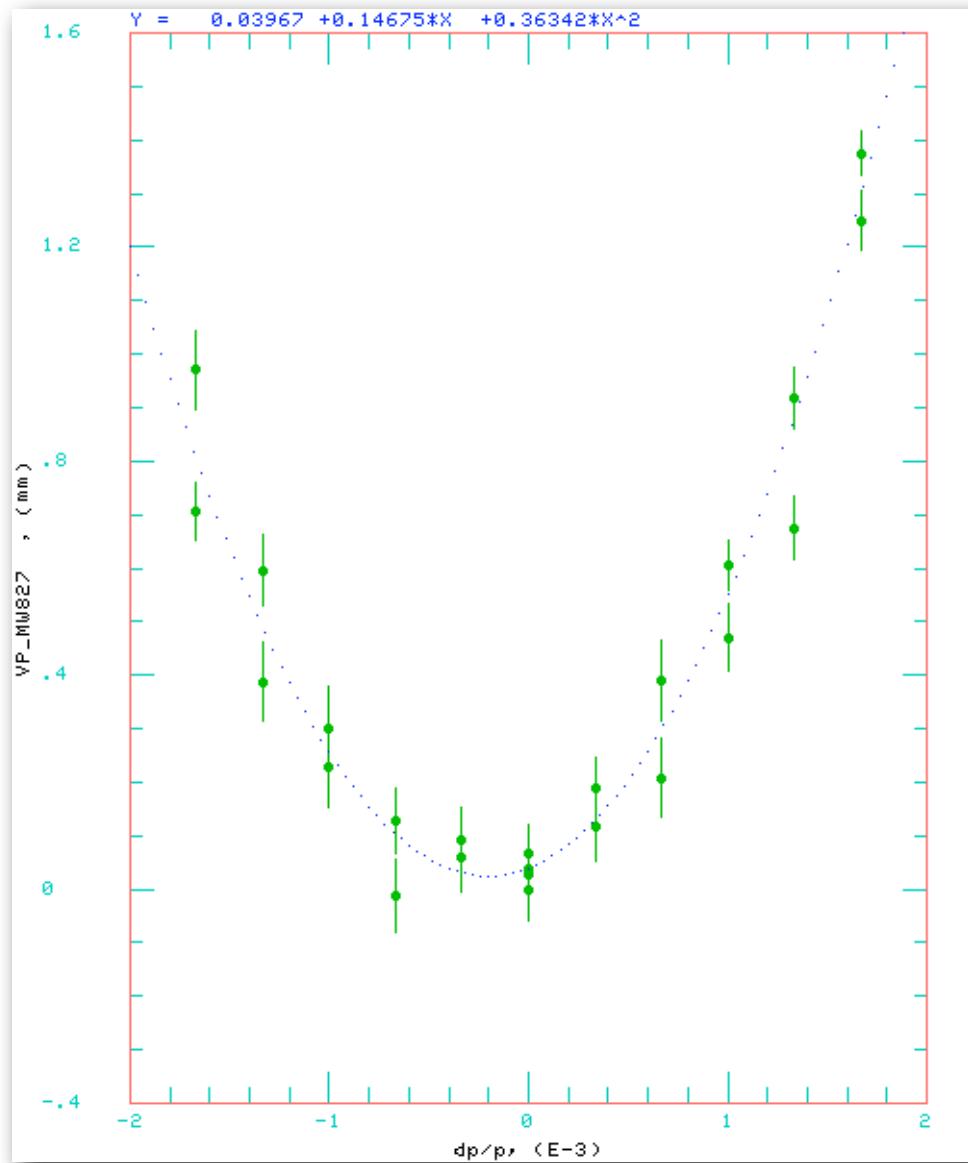
# Dispersion data



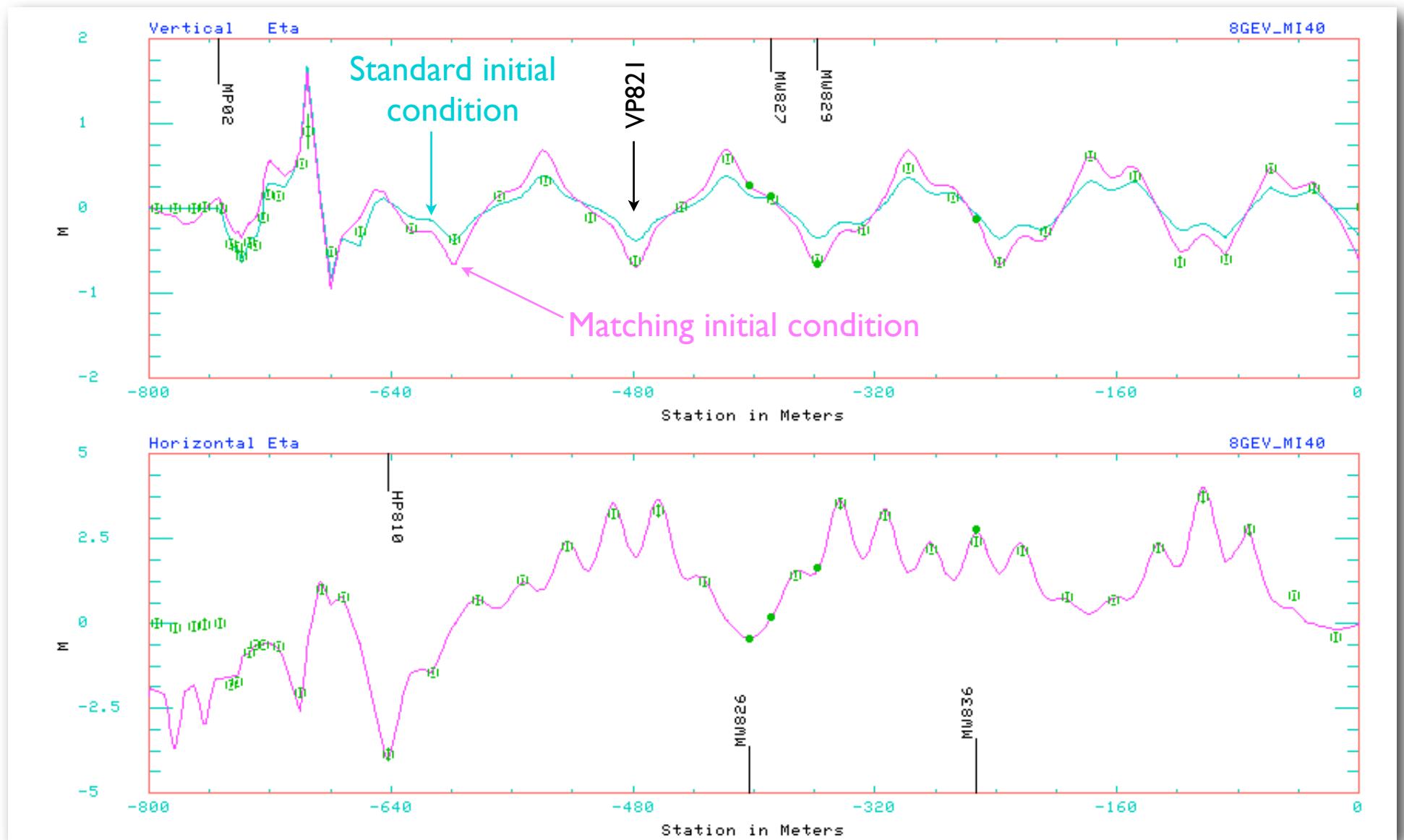
# Horizontal position vs $\Delta p/p$



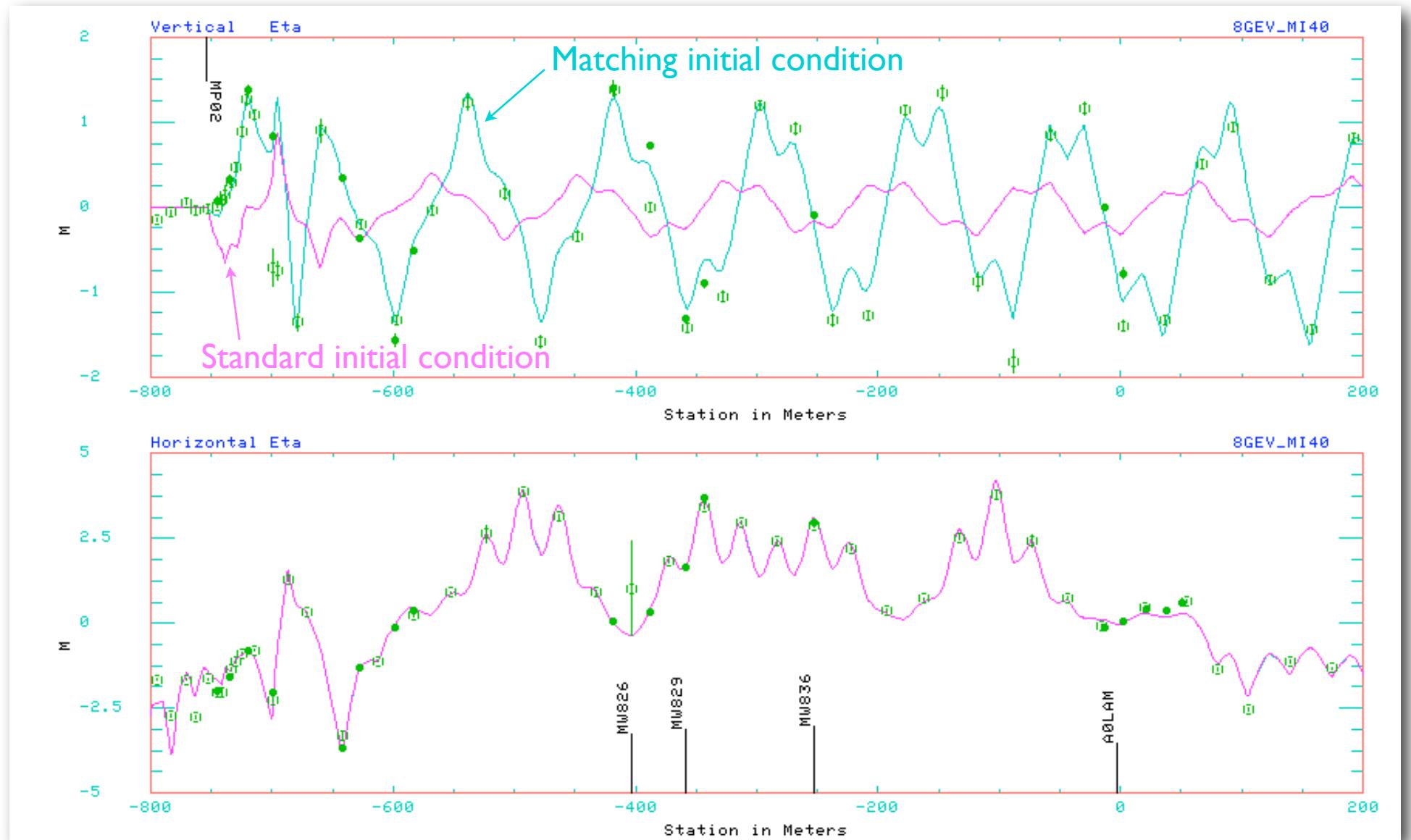
# Vertical position vs $\Delta p/p$



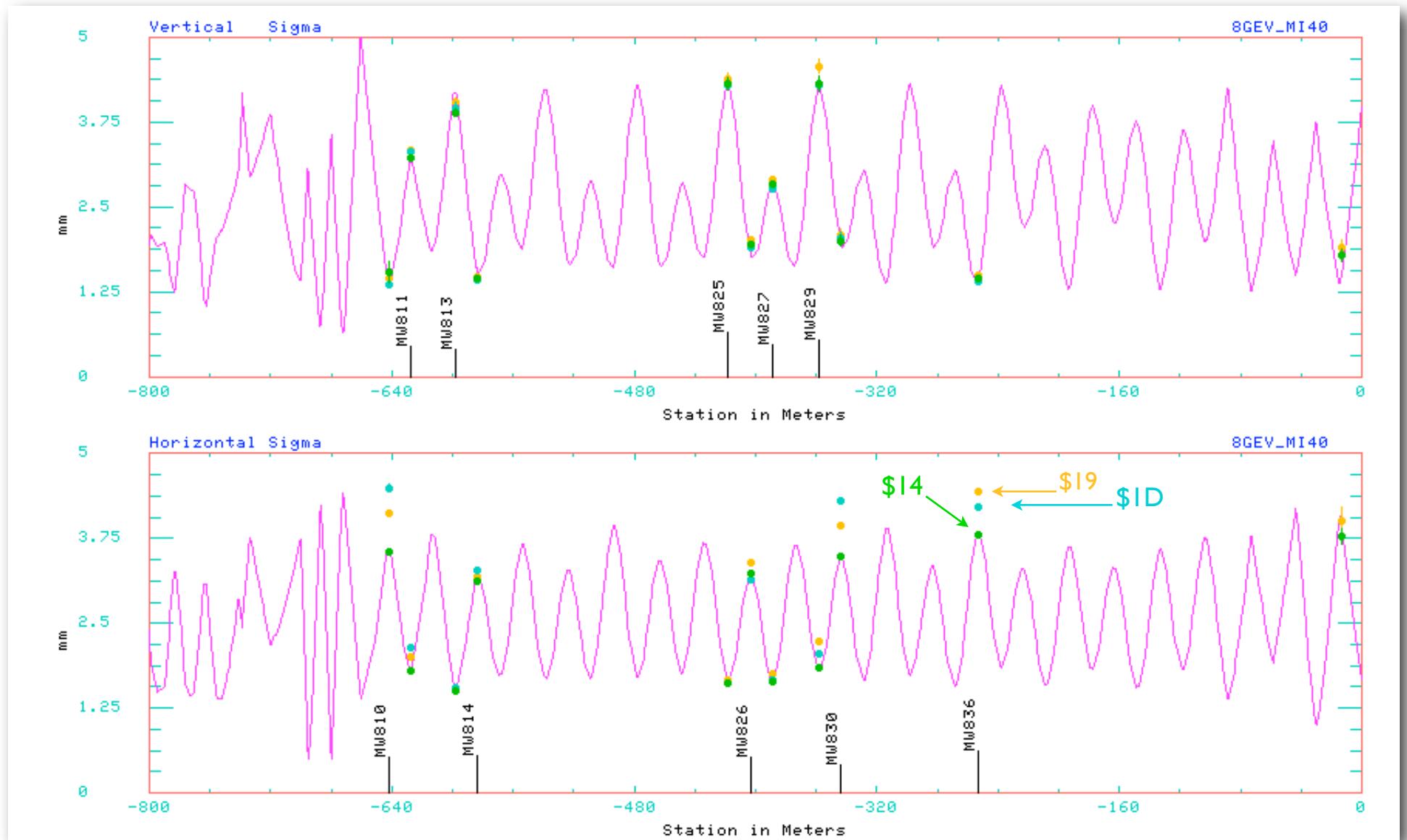
# Measured dispersion function



# MI8 line dispersion function at staru-up



# Profile sigma



# Fitted emittances & initial lattice

```
Lattice parameters
Select: [8GEV_MI40 ] as [Transfer line]
Start at element: [B00_CELL01] for [Proton ]
*Track: [Lattice function] at ( 8

Lattice      Horz          Vert
Phase: ( 24.5184) ( 23.6573) 2π
Beta: ( 56.573 ) ( 7 ) M
Alpha: (-.213 ) ( .23 )
eta: (-3.189 ) ( .065 ) M
etap: (-.011 ) ( -.013 )

Beam
Position: ( 0 ) ( 0 ) mm
Angle: ( 0 ) ( 0 ) mr
Emittance: ( 2.35786) ( 2.43193) π-ι
± .036694 ± .263049
ΣP/P: (.794332) ± .01862 E-
△P/P: ( 0 ) E-
```

\*Fit emittance: [Emitt & sig\_p/p]
Momentum sigma from [Horizontal] plane

\*Update [reference orbit]
Graphic window link: [None ]
\*Set lattice to [Linear] order and wi

<Exit>

\$1D

```
Lattice parameters
Select: [8GEV_MI40 ] as [Transfer line]
Start at element: [B00_CELL01] for [Proton ]
*Track: [Lattice function] at ( 8

Lattice      Horz          Vert
Phase: ( 24.5184) ( 23.6573) 2π
Beta: ( 56.573 ) ( 7 ) M
Alpha: (-.213 ) ( .23 )
eta: (-3.189 ) ( .065 ) M
etap: (-.011 ) ( -.013 )

Beam
Position: ( 0 ) ( 0 ) mm
Angle: ( 0 ) ( 0 ) mr
Emittance: ( 2.69415) ( 2.71464) π-ι
± .139789 ± .266679
ΣP/P: (.669482) ± .0765 E-
△P/P: ( 0 ) E-
```

\*Fit emittance: [Emitt & sig\_p/p]
Momentum sigma from [Horizontal] plane

\*Update [reference orbit]
Graphic window link: [None ]
\*Set lattice to [Linear] order and wi

<Exit>

\$19

```
Lattice parameters
Select: [8GEV_MI40 ] as [Transfer line]
Start at element: [B00_CELL01] for [Proton ]
*Track: [Lattice function] at ( 8 ) GeV

Lattice      Horz          Vert
Phase: ( 24.5184) ( 23.6573) 2π
Beta: ( 56.573 ) ( 7 ) M
Alpha: (-.213 ) ( .23 )
eta: (-3.189 ) ( .065 ) M
etap: (-.011 ) ( -.013 )

Beam
Position: ( 0 ) ( 0 ) mm
Angle: ( 0 ) ( 0 ) mr
Emittance: ( 2.43718) ( 2.54244) π-MM-MR
± .037717 ± .218438
ΣP/P: (.354292) ± .03609 E-3
△P/P: ( 0 ) E-3

*Fit emittance: [Emitt & sig_p/p]
Momentum sigma from [Horizontal] plane

*Update [reference orbit]
Graphic window link: [None ]
*Set lattice to [Linear] order and with [Matrix]
```

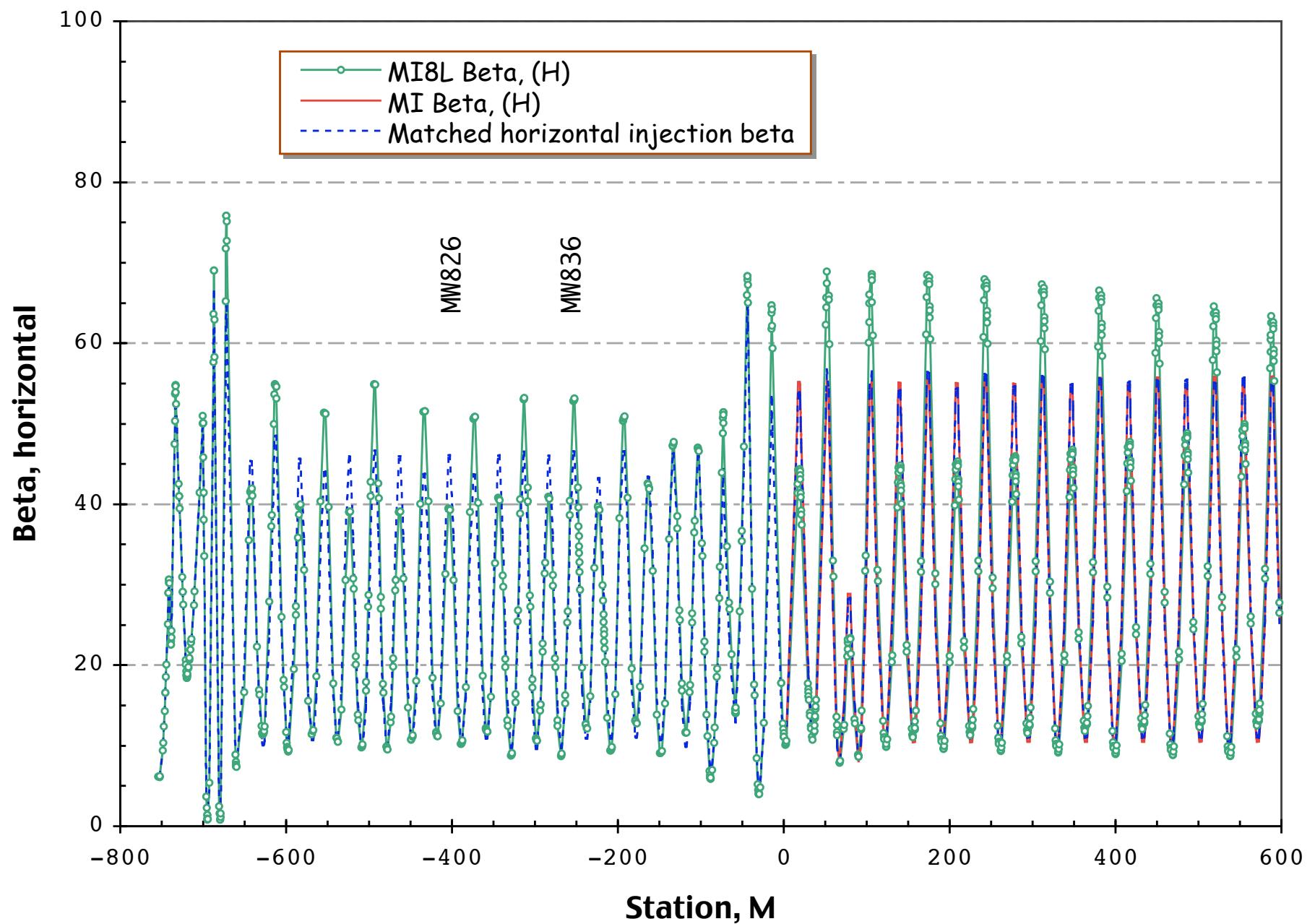
<Exit>

\$14

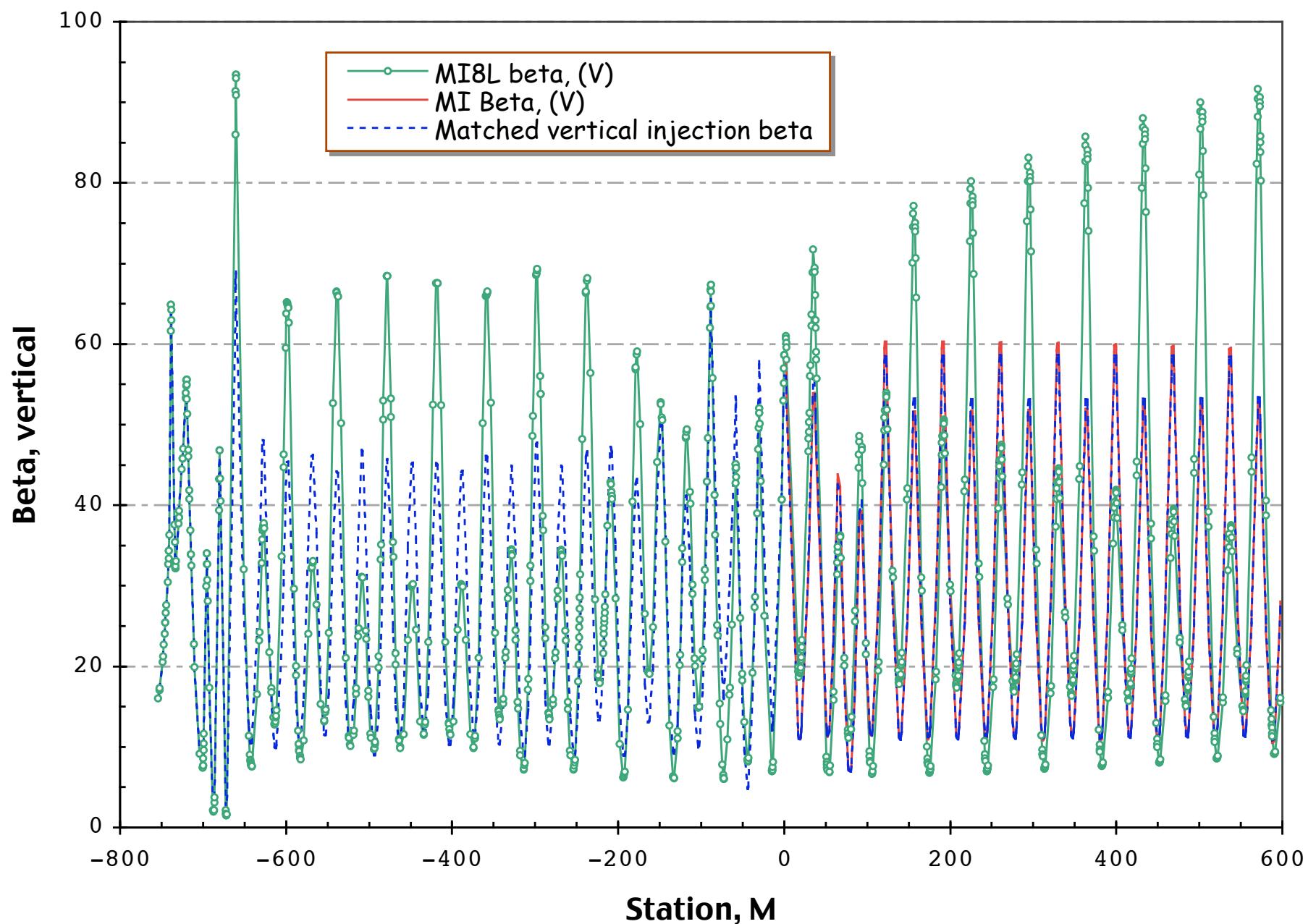
# Comparing measured emittances

	\$14	\$19	\$1D	
$\Delta p/p$	$0.35 \pm .04$	$0.67 \pm .08$	$0.79 \pm .02$	E-3
Horz emitt. ( $1\sigma$ )	$2.44 \pm .04$	$2.69 \pm .14$	$2.36 \pm .04$	$\pi\text{-mm-mm}$
Vert emitt ( $1\sigma$ )	$2.54 \pm .22$	$2.71 \pm .27$	$2.43 \pm .26$	$\pi\text{-mm-mm}$

# MI injection beta, horizontal



# MI injection beta, vertical



# Settings of MI8 line quads

DB_name		Setting	Reading	Calculation	Difference	matched reading	increment
B:MP02I	Amps	22566.83		22484.06		22484.06	
MP02T	AMPS	0		0		0	
B:MI8BND	AMP	1799.393		799.9719		799.9719	
Q800	AMP		211.26	211.6619	0.40	211.6619	0.0
Q801	AMP		171.32	188.9619	17.64	188.9619	0.0
Q802	AMP		167.126	166.9559	-0.17	166.9559	0.0
Q803	AMPS		102.387	104.7937	2.41	104.7937	0.0
Q804	Amps		225.56	223.7419	-1.82	222.5419	-1.2
Q805	Amps		245.62	245.5819	-0.04	245.5819	0.0
Q806	Amps		164.03	166.9559	2.93	165.7559	-1.2
Q807	Amps		149.226	150.3959	1.17	146.1959	-4.2
Q808	Amps		199.62	200.1019	0.48	200.1019	0.0
Q809	Amps		201.62	204.1419	2.52	200.7419	-3.4
Q847	Amps		158.936	156.9113	-2.02	141.9113	-15.0
Q848	Amps		143.896	148.9113	5.02	146.8113	-2.1
Q849	Amps		169.856	169.6613	-0.19	153.6613	-16.0
Q850	Amps		161.336	168.3213	6.99	164.6213	-3.7
Q851	Amps		147.456	164.0513	16.60	163.8513	-0.2
Q852	Amps		162.876	167.8013	4.93	165.1013	-2.7
B:Q800S	Amps	43.74	43.05	43.3225		43.3225	0.0
B:Q801S	Amps	42.18	41.69	25.0225		26.0225	1.0
B:Q802S	Amps	15.60	15.73	15.8425		15.8425	0.0
B:Q804S	Amps	29.44	28.85	31.2425		32.4425	1.2
B:Q805S	Amps	9.38	9.25	9.4025		9.4025	0.0
B:Q806S	Amps	18.70	18.65	15.8425		17.0425	1.2
B:Q807S	Amps	33.50	33.29	32.4025		36.6025	4.2
B:Q808S	Amps	13.88	13.85	13.8825		13.8825	0.0
B:Q809S	Amps	11.88	11.81	9.8425		13.2425	3.4
I:Q847S	Amps	10.92	10.90	17.9325		32.9325	15.0
I:Q848S	Amps	25.96	15.88	25.9325		28.0325	2.1
I:Q849S	Amps	0.00	0.20	5.1825		21.1825	16.0
I:Q850S	Amps	8.52	8.50	6.5225		10.2225	3.7
I:Q851S	Amps	22.40	22.35	10.7925		10.9925	0.2
I:Q852S	Amps	6.98	7.03	7.0425		9.7425	2.7
B:Q800	AMP	254.9896	255	254.9844		254.9844	
B:Q801	AMP	215.4999	213.5	213.9844		213.9844	
B:Q802	AMP	183.103	182.726	182.7984		182.7984	
B:Q803	AMPS	101.001	102.387	104.7937		104.7937	
I:Q847	AMP	171.503	169.856	174.8438		174.8438	

# Next

- ❖ Optics from 805 to 848 settled
  - ▶ Need MPØ2/VT805/VT807 3-bump to clarify Q801.
  - ▶ Need MI flash orbit to certify optics beyond 848.
- ❖ Beta wave from MI8 line into MI
  - ▶ IPM data.
  - ▶ I:Q851S is critical.
  - ▶ Ring lattice function measurement.
- ❖ Emittance monitor
  - ▶ The existing beta wave is unfavorable.
  - ▶ Make it a favorable beta wave?